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IMPACT OF CORONAVIRUS PANDEMIC ON INDIAN EQUITY MARKETS - OVERVIEW OF KEY SECTORS

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I. Introduction

Economies in the past at the firm, as well as at an individual level, have witnessed a succession of crises like the 1997 Asian Economic Crisis, the 2000-2002 Dot com bubble, post 9/11 downturn, the 2007-09 financial crisis (Wenzel et al.,2020). Although these crises had different origins and scales (Bansal et al.,2018), their commonality was the cataclysmic impact on the world, leading to widespread disruption of industries, massive job cuts, income insecurity, and damages (Hällgren et al., 2018).

A pandemic is defined as "an epidemic occurring worldwide, or over a wide area, crossing international boundaries and usually affecting a large number of people" (WHO,1998).An analysis of the impacts of such epidemic diseases is vital as severe epidemic diseases are a recurrent phenomenon with grave consequences for human life and the real economy (Qualls et al.,2017). Seeing the severity of such a crisis, the World Health Organization on 11th March 2020 assessed that coronavirus be characterized as a pandemic (WHO,2020). With the continuing spread of coronavirus, governments have had to put in place robust measures to lessen deaths, including the prohibition of events, lockdowns, and even shutdowns for months together. Based on current and historical data, we can see that the spread of coronavirus is much faster than prior epidemics viz. S.A.R.S, M.E.R.S, and Ebola. It is the first instance in peacetime, where there is a simultaneous disruption in the supply chain and the demand chain (Siegel,2020).

An increase in the number of confirmed cases and deaths due to coronavirus is responsible for a significant rise in market illiquidity and volatility (Baig et al.,2020). The successive implementations of restrictions and lockdowns worldwide further contribute to the deterioration of the liquidity and stability of markets (Baig et al., 2020).Hence in such a scenario, understanding of the intermarket volatility has become paramount for the pricing of securities within and across the markets for trading and for developing hedging strategies for an emerging market like India that is rapidly getting integrated into the global economy (Mishra et al.,2007).

Hence our study is aimed at adding to the existing literature on market response to pandemics in emerging economies like India on two fronts; volatility and returns. Further, we set out to examine whether the impact of coronavirus is homogenous across key sectors. We also seek to empirically examine how the returns of the different sectors are related to the volatility measures. This has implications for retail as well as institutional investors among other market participants.

II. Literature Review

Coronavirus was first identified in Wuhan, China, before spreading worldwide. This new coronavirus spread very rapidly and had a mortality rate approximately ten times higher than the seasonal flu, and at least twice it's infection rates (Baker et al.,2020). Previous studies have reflected on the importance of understanding the interplay between epidemics and financial crises (Suhrcke et al.,2011). Both have the capacity to spread in an interconnected and globalized world with increased mobility of people, capital, information, and commodities (Knobler et al.,2006).

A few authors have specifically focused on the coronavirus crisis and its consequences on financial markets, including Kargar et al. (2020), Fleming et al. (2020), and Schrimpf et al. (2020). Government restrictions on commercial activity in response to COVID-19 are more stringent, broader in scope, more widespread, and lengthier in duration than policy responses to the Spanish flu and entirely unlike the governmental response to the 1957-58 and 1968 influenza pandemics.

Although previous studies have looked into the relationship between volatility and returns of stocks, there is a dearth of studies that examine the changes during the time of crisis. Vliet (2011) concedes that the different outcomes of prior work in this area are related to the choice of different methodologies. This paper employs a relatively novel approach to examine the empirical evidence for a relationship between returns on stock indices (both market and sectoral) and their volatility. Further, we have classified sectors based on this relationship either as long volatility or as short volatility. The long volatility sector, by definition, means that the returns from the sector increase when the financial markets become volatile. Similarly, short volatility indicates that returns from the sector go down with increase of volatility as per Taleb 2013.

III. Data and Methodology

a. Data

The Nifty 50 index serves as the basis for the analysis in this paper. The Nifty 50 index (Nifty hereafter) is based on the stocks listed and traded on the National Stock Exchange (NSE). The Nifty tracks the behavior of a portfolio of 50 reputed and the most liquid companies listed on the NSE(Jayabal,2010). It captures about 60 percent of its equity market capitalization and covers 22 sectors of the Indian economy. Hence, NSE offers particular advantages for a study of this kind.

As we are dealing with a smaller number of observations (58), we conducted the Jarque–Bera test for normality. As our return series was found to be non-normal, we used the chi-square Test and the Levene's non-parametric test to test whether our means of return and variance of returns for each period were significantly different. Both of these tests are non-parametric tests that provide the benefits (of being used with very skewed distributions or when the population variance is not homogeneous) over parametric tests.

b. Methodology

We have three main objectives: -

1. To investigate the impact of coronavirus on Indian equity markets based on
   i. Equity Returns
   ii. Historical Volatility
2. To examine whether the impact of coronavirus is homogenous across key sectors
   i. Whether there is a significant difference in equity returns across periods?
   ii. Whether there is a significant difference in the historical volatility across periods?
3. To study the implications of volatility on equity returns of the overall Indian market and different sectors? To explore whether a particular sector exhibits Long Volatility or Short Volatility.

Let us delve into each of these separately for a clear understanding.

1. Impact of coronavirus on Indian equity markets

i. Study of Equity Returns

We have used the closing value of the NIFTY 50 index for calculating our index return series. The return series was constructed for two periods. First series begins from March 1st,2020 (58 Days - closing index values) (say Period T). This is compared with another return series starting exactly one year prior i.e., beginning March 1st,2019 (58 Days - closing Index Values) (say Period T-1).

Please note that the onset of coronavirus cases in India started in March 2020, which prompted us to select such a timeframe. Logarithmic 5-day returns were computed for obtaining the return series.

ii. Study of Historical Volatility

We have calculated historical volatility by using the standard deviation of the logarithmic 5-day return series for both the periods T and T-1. Historical volatility is a measure of the dispersion of returns for a given market index over a given period of time. We have used the Levene's Non-Parametric Test to determine whether the volatility of the logarithmic 5-day returns series for the period T-1 was significantly different from that of the period T.

2. Is the impact of coronavirus homogenous across key sectors?

We wanted to find out whether the impact of coronavirus is homogenous across key sectors by scrutinizing various indexes.

Hence, we chose four key sectors for our study, namely - Pharma, F.M.C.G, Financial Services and Realty We have used the closing value of the following NIFTY Indexes for calculating our index return series corresponding to each of the sectors.

i. Study of Equity Returns

The return series was constructed for two periods. First series starts from March 1st,2020 (58 Days). This was compared with another return series starting precisely one year prior i.e., beginning March 1st,2019 (58 Days) for each of the four sectors. Logarithmic 5-day returns were computed for obtaining the returns series

ii. Study of Historical Volatility

We have calculated historical volatility by taking the standard deviation of the logarithmic 5-day return series for both the periods T and T-1 for the above mentioned four sectoral indices.

3. Implications of volatility on equity returns of Overall Indian Market as well as different sectors

We have taken volatility of logarithmic 5-day returns of Nifty-50 Index and sectoral indices for the following five periods

a) Period T: Starting from March 1st,2020
b) Period T-1: Starting from March 1st,2019
c) Period T-2: Starting from March 1st,2018
d) Period T-3: Starting from March 1st,2017
e) Period T-4: Starting from March 1st,2016

We have further carried out correlation analysis between the volatility and return series to determine whether a particular sector exhibits long volatility or short volatility.

i. Correlation between the volatility of logarithmic 5-day returns of sectoral Indices for five time periods and Median of logarithmic 5-day returns of Sectoral Indices
ii. Correlation between the volatility of logarithmic 5-day returns of sectoral indices for five time periods and Cumulative daily growth rate (C.D.G.R) of sectoral indices

IV. Results and Discussion

1. Impact of coronavirus on Indian equity markets

i. Study of Equity Returns

Logarithmic 5-day return of period T is lower than the period T-1 (by 2.45 %)

Table 3: Correlation Study of Volatility & Median of Logarithmic 5-day Returns

Sr No.	Segment	Correlation	Meaning
1	Market	-0.97	Strong Negative Correlation
2	Pharma Sector	0.62	Strong Positive Correlation
3	F.M.C.G Sector	-0.16	Weak Negative Correlation
4	Financial Services Sector	-0.95	Strong Negative Correlation
5	Realty Sector	-0.59	Strong Negative Correlation

We set out to determine whether this difference in the return between two periods is significant. For this, we will be using the chi-square test of independence to test the following hypothesis: -

H_0: - The means are same for the two sets of observations
H_A: - The means are not same for the two sets of observations

Table 4: Correlation Study of Volatility & C.D.G. R			
Sr No.	**Segment**	**Correlation**	**Meaning**
1	Market	-0.89	Strong Negative Correlation
2	Pharma Sector	0.96	Strong Positive Correlation
3	F.M.C.G Sector	-0.39	Moderate Negative Correlation
4	Financial Services Sector	-0.98	Strong Negative Correlation
5	Realty Sector	-0.75	Strong Negative Correlation

For the above chi-square test of independence, the chi-square statistic is 9.1274, with calculated p-value as 0. 002518.We can find that our calculated p-value (0.002518) is lower than 0.05. Hence, we reject the null hypothesis, and we can conclude that the means are not the same for the two sets of observations. There is a significant difference between the means of logarithmic 5-day returns for period T and T-1.

ii. Study of Historical Volatility

From our study, we can find that the volatility of logarithmic 5-day returns of period T is higher than that from that of period T-1 by 2.77 %.

Next, we set out to determine whether the volatility of the two periods is significantly different from each other. For this, we will be using the Levene's Non-Parametric test to test the following hypothesis: -
H_0: - The variance is same for the two sets of observations
H_A: - The variance is not same for the two sets of observations

The p-value calculated from Levene's Test was found to be 0.00000017.

Therefore, we reject the null hypothesis. We can conclude that the variance is not the same for the two sets of observations, and there is a significant difference between the volatility of logarithmic 5-day returns for periods T and T-1.

2. Is the impact of coronavirus homogenous across key sectors?

i. Study of Equity Returns

Let us compare how the return series varies across key four different sectors for the two time periods. (refer Table 1)

Table 1

Comparison of Mean Logarithmic 5-day Return for the two periods				
Sr No.	**Sectors**	**Mean Return - Ln 5 Day**		**Difference in Return % w.r.t 2020**
		2019	**2020**	
1	Pharma	-0.56%	1.75%	2.31%
2	F.M.C. G	0.08%	-0.29%	-0.36%
3	Financial Services	1.37%	-3.69%	-5.06%
4	Realty	1.69%	-4.66%	-6.35%

Chi-square Test for comparing Means of Logarithmic 5-Day Returns

Sr No.	Sector	Chi Square Value	p-value Calculated	p - value Theoretical	Hypothesis	Meaning	Difference between Mean of Returns
1	Pharma	4.81	0.0283	0.05	REJECT HYPOTHESIS	Means are different	SIGNIFICANT
2	F.M.C.G	0.94	0.3311	0.05	ACCEPT HYPOTHESIS	No Difference of Means	INSIGNIFICANT
3	Finserv	25.94	0.00001	0.05	REJECT HYPOTHESIS	Means are different	SIGNIFICANT
4	Realty	8.68	0.0032	0.05	REJECT HYPOTHESIS	Means are different	SIGNIFICANT

We can conclude that the Realty, Financial Services sectors were severely affected during the pandemic. We can also see that F.M.C.G sector has a negligible to no impact, whereas the Pharma sector has made a significant gain during these times of uncertainty.

We set out to find out whether this difference of the return between two periods is significant enough for the above mentioned six key sectors. We will be using the chi-square test of independence to test the following hypothesis: -

H_0: - The means are same for the two sets of observations

H_A: - The means are not same for the two sets of observations

From this observation(Refer Table 1), we can conclude that the Pharma sector has made significant gains during this time of crisis; in contrast, the Financial Services and Realty sectors have made substantial losses. No significant impact can be noticed on the F.M.C.G as well as Auto sectors.

ii. Study of Historical Volatility

We can see (from Table 8) that the volatility has gone up for all the sectors.

Table 2

Comparison of Volatility of Logarithmic 5-day Return for the two periods				
Sr No.	**Sectors**	**Volatility**		**Difference in Volatility % w.r.t 2020**
		2019	**2020**	
1	Pharma	1.02%	2.99%	1.97%
2	F.M.C. G	0.77%	3.04%	2.27%
3	Financial Services	1.09%	4.60%	3.51%
4	Realty	1.59%	3.60%	2.01%

Levene's Test for comparing the variance of Logarithmic 5-Day Returns						
Sr No.	**Sector**	**p-Value Calculated**	**p - Value Theoretical**	**Hypothesis**	Meaning	**Difference between Variance**
1	Pharma	0.000000446	0.05	REJECT HYPOTHESIS	Variance are different	SIGNIFICANT
2	F.M.C.G	0.000000019	0.05	REJECT HYPOTHESIS	Variance are different	SIGNIFICANT
3	Finserv	0.000000551	0.05	REJECT HYPOTHESIS	Variance are different	SIGNIFICANT
4	Realty	0.07	0.05	ACCEPTHYPOTHESIS	No Difference of Variance	INSIGNIFICANT

Further, we try to determine whether the volatility of the two periods is significantly different from each other. For this, we will be using the Levene's Non-Parametric test to test the following hypothesis: -

H_0: - The variance is same for the two sets of observations

H_A: - The variance is not same for the two sets of observations

From Table 2, we can find that except for the Realty sector, all other sectors, namely Pharma, F.M.C.G and Financial Services, have witnessed a significant increase in volatility.

3. Implications of the volatility of equity returns of Indian markets as well as different sectors

i. Correlation between the volatility of logarithmic 5-day returns for five time periods and Median of logarithmic 5-day returns

Table 3

Table 3: Correlation Study of Volatility & Median of Logarithmic 5-day Returns			
Sr No.	**Segment**	**Correlation**	**Meaning**
1	Market	-0.97	Strong Negative Correlation
2	Pharma Sector	0.62	Strong Positive Correlation
3	F.M.C.G Sector	-0.16	Weak Negative Correlation
4	Financial Services Sector	-0.95	Strong Negative Correlation
5	Realty Sector	-0.59	Strong Negative Correlation

ii. Correlation between the volatility of logarithmic 5-day returns for five time periods and Cumulative Daily Growth Rate (C.D.G.R) indices

Table 4

Table 4: Correlation Study of Volatility & C.D.G. R			
Sr No.	**Segment**	**Correlation**	**Meaning**
1	Market	-0.89	Strong Negative Correlation
2	Pharma Sector	0.96	Strong Positive Correlation
3	F.M.C.G Sector	-0.39	Moderate Negative Correlation
4	Financial Services Sector	-0.98	Strong Negative Correlation
5	Realty Sector	-0.75	Strong Negative Correlation

From the above tables, we can draw the following conclusions for the market as well as the different sectors: -

a. Market

Market returns showed a strong negative correlation with volatility, indicating that with an increase of volatility in the markets, the returns will decrease. Hence, we can say that Indian Equity Markets can be categorized as short volatility. But this is a generalization at best, so let us look specifically into the study related to different sectors for a better understanding of each sector and how they react differently when posed with rising uncertainty.

b. Sectors

1. Pharmaceuticals: -Volatility and returns are strongly positively correlated. Whenever volatility or uncertainty increases, the pharma sector tends to gain from this uncertainty. Hence, we can classify the Pharmaceuticals sector as a long volatility sector.

2. **Fast Moving Capital Goods:** - Volatility and returns seem to exhibit weak to moderate negative correlation. This signifies that with a rise in volatility or uncertainty, the F.M.C.G sector tends to be affected to a lesser extent as compared to the Financial Services and Realty sector. Therefore, this is neither long volatility nor a short volatility sector.

3. **Financial Services**: - Volatility and returns are strongly negatively correlated. This indicates that whenever volatility increases, the financial services sector suffers losses. Hence, we can classify the financial services sector as a short volatility sector.

4. **Realty**: - Strong negative correlation is exhibited between volatility and returns. Thus, whenever volatility rises, it is highly likely that the realty sector will go into losses. Hence, we can classify the Realty sector as a short volatility sector.

V. Implications for Market Participants

We are certain that the markets will tend to remain choppy with high levels of uncertainty, as indicated by our study. Therefore, investment decisions must consider the above-found results to ride the upheaval from this crisis. Hence investors investing in Indian markets may be inducting equities from the pharmaceutical sector in their portfolio. In our study, the pharma sector is found to be long volatility. With coronavirus being a health-related crisis, markets are bound to take any new information regarding the development of new drugs or vaccines as a positive development.

Similarly, investors should attempt to reduce their exposure to Realty and Financial Services sectors to cut their losses as they are short volatility. One logical explanation is that the coronavirus crisis is yet to be contained, ergo normal behavior of people will majorly be focused on savings rather than taking loans from banks and using it for capital expenditure. In addition to that, with long periods of shutdown and

migration of workforce, the factories are bound to keep operating at reduced capacity for some time to come, hence reducing the requirement of working capital loans to a considerable extent. Thus, for a financial institution, Net Interest Margins will take a significant dip, which in turn will affect the earnings. Similarly, at this time of crisis, there is a definite reduction in demand for owning/renting new houses, office spaces, buildings. This creates a major demand-side shock for the realty sector as health and safety is the primary concern for the larger populace as compared to owning real assets.

Further, investment in F.M.C.G will ensure a steady return from portfolios as they exhibit a weak correlation between volatility and returns. This can be justified with the fact that Fast moving consumer goods are the products of the utmost necessity for the day to day survival of the population. Hence, volatility might not have a significant impact on this sector for a longer duration.

VI. Conclusion and Limitation

Indian market Index (NIFTY-50), and various key sectoral indices, were studied to understand the interplay between volatility and returns. We then set out to test the robustness of our data to understand the difference in the returns and the volatility was significant enough for the two specified periods of 2019 (before the pandemic) and 2020 (after the pandemic) by using the chi-square independence tests(for returns) and the Levene's Non-parametric test(for volatility). Further, we investigate whether the impact of coronavirus is homogenous across key sectors by making use of correlation analysis.

Firstly, our research only uses only 58 daily observations for each of the periods of study. We had to use a limited set of observations as the first case of coronavirus was detected in March in India, nearly one and a half months after the detection in the developed economies. Secondly, we are still not very sure about how long this high period of volatility (due to corona) will continue, hence the recommendations from our studies might not be applicable once the volatility reduces and markets come back to normalcy.

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